CLAIMS

We claim:

1. A device consisting of a plurality of distance sensors, arranged to make measurements on one or more surfaces of an object whose surface profile is of interest. The object and sensors are moved relative to one another in a known way so that distance measurements can be made by some or all sensors at known intervals along the specimen surface(s). By this means, substantially similar points on the object may be measured by different sensors within a sequence of measurements. The desired relative motion may be achieved by either moving the sensors, or the object, or both. The surface profile(s) of interest is/are determined from the sensor readings by a method that identifies features appearing in corresponding sensor data in delayed sequence. Any relative rigid-body motions that occur in the measurement direction are evaluated by a method that identifies features simultaneously appearing in the sensor data.

2. A device according to Claim 1 where a plurality of distance sensors are arranged along a single line such that some sensors can measure some substantially similar points on the object that were previously measured by other sensors. FIG. 2 schematically illustrates an example sensor arrangement of this kind that is particularly useful for measuring surface profile along a surface of an object.

3. A device according to Claim 1 where a plurality of distance sensors are arranged along two or more parallel lines facing opposite surfaces of an object. Within one or more lines, some sensors can measure some substantially similar points on the object that were previously measured by other sensors. FIG. 4 illustrates an example sensor arrangement of this kind that is particularly useful for simulataneously measuring opposite surface profiles and thickness profile of an object.

4. A device according to Claim 1 where a plurality of distance sensors are arranged along two or more parallel lines facing the same surface of an object. Within one or more lines, some sensors can measure some substantially similar points on the object that were previously measured by other sensors. FIG. 5 illustrates an example sensor arrangement of this kind that is particularly useful for simulataneously measuring parallel profiles and twist along a surface of an object.

5. A device according to Claim 1 where a plurality of distance sensors are arranged along

several parallel lines facing the two or more surfaces of an object. Within one or more lines, some sensors can measure some substantially similar points on the object that were previously measured by other sensors. FIG. 6 illustrates an example sensor arrangement of this kind that is particularly useful for simulataneously measuring parallel surface profiles, thickness profiles and twist of an object.

6. A device according to Claim 1 where a plurality of line-type distance sensors measure lines across one or more surfaces of an object. The measured lines are different from each other, such that some of the measured points along one or more lines on the object are substantially similar to points that were previously measured along other lines. FIG. 7 illustrates an example sensor arrangement of this kind that is particularly useful for measuring two-dimensional surface shape.

7. A data processing system that receives data from distance sensors, and identifies surface profiles from features that appear in corresponding sensor data in delayed sequence. It identifies any relative rigid-body motions in the measurement direction(s) from features that appear simultaneously in the sensor data.

8. A data processing system according to Claim 7 where the identification of delayed and simultaneous features is achieved by solution of a matrix equation of the general type shown in equations (2), (3) and (4), with the matrix contents adjusted to apply to the specific geometrical arrangement of the distance sensors used.

9. A data processing system according to Claim 7 where the identification of delayed and simultaneous features is achieved by solution of "Normal" equations of the type shown in equations (5) and (6), with the matrix contents adjusted to apply to the specific geometrical arrangement of the distance sensors used.

10. A data processing system according to Claim 7 where result stabilization and/or smoothing is achieved by using regularization.

11. A data processing system according to Claim 8 where the regularization type is Tikhonov regularization.

12. A data processing system according to Claim 7, where evaluation of the surface profile(s) is/are achieved using a matrix solution method after data collection has been completed.

13. A data processing system according to Claim 7, where evaluation of the surface profile(s) is/are achieved using a progressive solution method that may possibly be initiated before data collection has been completed.

14. A data processing system according to Claim 13 where the progressive solution involves the Gauss-Seidel, successive over-relaxation, or any related methods.